U.S. DOE Open-Source Buoy Platform for Testing New Offshore Instruments

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PNNL lidar-buoy-program

OBJECTIVE

The U.S. Department of Energy has designed and fabricated a new **open-source buoy platform**, called the instrumentation test buoy. The test buoy was designed to accommodate a range of future sensors both above and below water and have additional electric power, mounting locations, and data storage. The mission of the new buoy will be to evaluate the performance of new offshore sensors in the field.

OPEN-SOURCE BUOY

Open-access software will be made publicly available, in particular

- ***Data logging*** → All Campbell Scientific data logger codes for instruments and buoy control.
- ***Design and Control architecture*** → Drawings of the buoy and software to control the buoy power, communication, and operations.
- ***Communication*** → Software to automatically transfer data from the buoy to a remote server via Satellite/Wi-Fi.

INSTRUMENT TESTING

Current instrument testing plans:

- Atmospheric thermodynamic profilers,
- Remote sensing lidars (long-range),
- Radiometers and Ceilometers,
- Precipitation, lightning, Visibility etc.,
- Wildlife tracking/monitoring (avian radars, etc.),
- Testing power devices, such as wave energy converters
- SageNode – Edge computer and ML within an interconnected cyberinfrastructure, spanning multiple major science instruments and wind farms

DESIGN CONSIDERATIONS

Power

- Renewables support base buoy load
- Extra ~ 500 W available for test instrumentation
- Diesel generator as backup power supply for base load, may be relied on for extra capacity

Space and Mounting Locations

- Additional mounting options for instrumentation on mast, via moonpools, and on deck
- Internal compartment space for additional electronics, power needs

Communications

- Short range – WiFi for connectivity with nearby vessel
- Long range – 5G for locations in cell range, Iridium for farther offshore

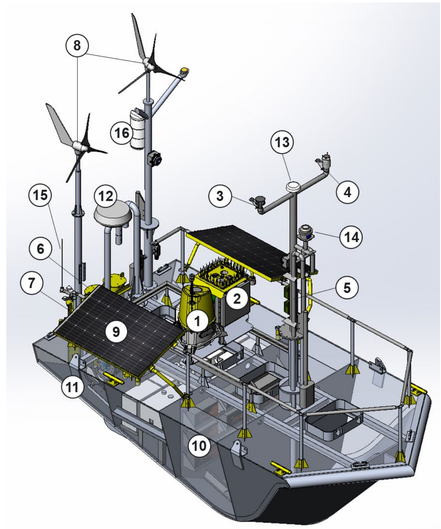
Data Logging

- Campbell Scientific CR1000X & Industrial PC
- On-board data processing to minimize transmission
- Minimum 3 TB onboard data storage to support 12 months of data acquisition

Software

- Data collection and instrument control software completely accessible and able to be modified for user defined needs.
- Seamless addition of new sensors into IPC
- Remote system controls to adjust sensor parameters during data collection campaign

Position and Safety – AIS, navigation light, GPS watch circle alarms, asset tracker, cameras (IR)



Scientific Sensors

1. ZX 300M LiDAR
2. Windcube v2.1 LiDAR
3. Gil ultrasonic anemometer
4. Vaisala WXT 536
5. Wildlife Acoustics bird and bat recorders (SM4)
6. Nortek Signature 250 AD2CP
7. Seabird 37 SMP CTD

Power

8. (2) SuperWind 350 turbines
9. (2) 320 W solar panels
10. (8) Lithium-ion phosphate batteries providing 24VDC
11. 5 kW diesel generator, 160 gallons capacity

Navigation/Communication

12. Thales Vessel link Iridium
13. Pep-link 5G and Wi-Fi
14. Navigation light
15. AIS antenna
16. Radar reflector









TEST YOUR SENSORS

Current Location for testing is at the Air-Sea Interaction Tower near Martha's Vineyard. Industry sensors currently being tested on the buoy, include:

a) Heitronics Infrared Radiation Thermometer (IRT) for Skin Sea Surface Temperature,
b) SeaView Systems wave sensor,
c) Campbell Scientific - Apogee - IRT with Standard Field of View.



Heitronics IRT being integrated on the DOE test buoy.

Data Access: DOE Wind Data Hub

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